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Book reviews

Water-Quality Engineering in Natural Systems, D.A. Chin. Wiley-Interscience, John Wiley & Sons, Inc., Hoboken, NJ (2006). 622 pp., Price: US$ 120.00, ISBN: 0-471-71830-0

This review departs from my normal format because in reading the book I found so many well-written descriptive sections that I decided to make this review one of quotes rather than originally generated material.

In the preface, the author writes:

> "Water-quality engineering is a specialty area in environmental engineering that includes the subspecialties of water treatment, wastewater treatment, and water-quality control in natural systems. This textbook is intended to encompass the latter subspecialty, and the content of this book constitutes baseline knowledge expected of water-quality engineers and managers. The need for competent water-quality engineers and managers is apparent when one realizes that in the United States over 50% of natural surface-water bodies do not meet their designated water uses and statutory water-quality goals. In addition, many shallow aquifers are contaminated by anthropogenic contaminants such as nitrates and organic chemicals, primarily pesticides and solvents. It is clear that water-quality engineering in natural systems will be an important practice area for the foreseeable future."

An overview of the book is given on the back cover.

> "This textbook details the fundamental equations that describe the fate and transport of contaminants in the water environment. The application of these fundamental equations to the design of environmental-control systems and methodologies for assessing the impact of contaminant discharges into rivers, lakes, wetlands, ground water, and oceans are all covered. Readers learn to assess how much waste can be safely assimilated into a water body by developing a solid understanding of the relationship between the type of pollutant discharged, the characteristics of the receiving water, and physical, chemical, and biological impacts. In cases of surface runoff from urban and agricultural watersheds, quantitative relationships between the quality of surface runoff and the characteristics of contaminant sources located within the watersheds are presented."

To illustrate material in the book, I again quote from the author's preface. The length of this quote is longer than I like, but I include it in total because it is so comprehensive and well done.

> "The book begins with an introduction to the principles of water-quality control and the laws and regulations relating to water-quality control in the United States. Particular attention is given to use-attainability analyses and the estimation of total maximum daily loads, both of which are essential components of water-quality control in natural systems. Chapter 2 covers the essential components of water-quality standards, including the physical, chemical, and biological measures of water quality. Chapter 3 covers the mathematical formulation of fate and transport processes in aquatic systems, including the derivation of the advection-dispersion equation from first principles and the mathematical solution and properties of this fundamental equation. The advection-dispersion equation is applicable to all natural waters. Chapter 4 covers fate and transport processes in rivers and streams, including lateral and longitudinal mixing from both instantaneous spills and continuous discharges, the fate of volatile organic compounds in streams and the depletion of dissolved oxygen in streams resulting from the discharge and accumulation of biodegradable organics. Guidelines for the restoration and management of polluted rivers are also provided. Chapter 5 describes water-quality processes in lakes and reservoirs, with particular emphasis on quantitative relationships describing flow and dispersion, sedimentation, eutrophication, nutrient recycling, and thermal stratification. Techniques to control eutrophication, dissolved-oxygen levels, toxic contaminants, acidity, and aquatic plants are all covered. Chapter 6 describes the occurrence, function, and hydrology of wetlands, the delineation of jurisdictional wetlands, and the design, construction, and operation of artificial (constructed) wetlands. Particular attention is given to factors controlling the contaminant-removal efficiencies in constructed wetlands. Chapter 7 covers water-quality-related processes in ground water, including the natural quality of groundwater; quantification of sources of ground-water contamination; advection, dispersion, and sorption onto aquifer materials; biochemical decay; and the fate and transport of nonaqueous phase liquids in ground water. Detailed coverage is provided on the application of fate and transport principles to the

remediation of contaminate ground water. Chapter 8 covers water-quality processes in oceans and estuaries, with particular emphasis on the design and operation of domestic wastewater outfalls, and water-quality control in estuaries as they relate to the physical, chemical, and biological conditions in the estuary. Chapter 9 covers water-quality-based watershed management where the primary focus is on estimating the contaminant loading on receiving waters from activities within the watershed. Detailed attention is given to sources of pollution and fate and transport processes associated with urban and agricultural watersheds. Atmospheric loading on natural waters due to airshed activities is also covered."

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Resource Recovery and Recycling from Metallurgical Wastes, S. Ramachandra Rao. Elsevier, Amsterdam, The Netherlands (2006). 580 pp., Price: US$ 150.00, ISBN: 0-08-045131-4

In the evolving world of pollution control, the current "hot topic" is sustainability, one facet of which is resource recovery from waste materials. In this book, Rao addresses that topic, focusing "... on metallurgical wastes, different sources where they occur, what they contain, which marketable materials can be recovered and the quantity of waste reduced, and the physical, chemical, biological and high temperature techniques used to achieve the objective."

Rao succinctly outlines the book's content in the preface, writing as follows: "An introductory chapter is followed by a chapter devoted to techniques of waste characterization. The next four chapters of the book describe the principles of various techniques and processes used in recycling and resource recovery. The next five chapters discuss the subject under specific topics each focusing on recycling and resource recovery from specific class of metallurgical waste. The last chapter discusses some of the newly developed and currently developing technologies, some of which may be successfully adopted for industrial use in future years."

The chapters are as follows:

1. Introduction
2. Waste characterization
3. Physical and physico-chemical processes
4. Hydrometallurgical processes
5. Biotechnological processes
6. Pyrometallurgical processes
7. Metal recycling
8. Metallurgical slags, dust and fumes
9. By-product processing and utilization
10. Resource recovery from process wastes
11. Recycling of water and reagents

The material provided by the author is explained in great detail and it appears (to this reader who is not a metallurgist) to be comprehensive covering virtually every metallurgical waste source. To illustrate my point, I will briefly describe the material in the Resource Recovery from Process Wastes chapter. In this chapter, the author has the following six sections, each of which has from 2 to 13 subsections. These subsections are by title: (1) Mineral process tailings, (2) Metallurgical effluents and residues, (3) Recovery of metal concentrates from waste sludges, (4) Solid wastes, (5) Resource recovery from discarded batteries, and (6) Metal recovery from spent petroleum catalysts.

Two chapters (discussed below) were of considerable interest to me personally as I am a biochemical/environmental engineer. The first chapter discusses biotechnological processes. To say the least, I was surprised to see this topic covered in a metallurgy text. The chapter was well written and one in which Rao discusses bacteria and bacterial processes including the description of bacterial morphology and growth. The rationale for the chapter in this book is that biomass can be used to recover metals.

The second of these chapters deals with water and its reuse. Removal of dissolved metals is not unexpectedly discussed. Adsorption on activated carbon and clay minerals as well as biosorption is briefly discussed. Ion exchange, removal by membranes, complexation, precipitate flotation and anaerobic treatment are among a host of other metal removal processes mentioned, albeit briefly. References are given for the interested reader who wishes more detail. Indeed, the author cites more than 700 articles in the reference section at the end of the book.

I must commend the author on his writing of this book. He has written an excellent, detailed technical treatise that comprehensively covers this topic. The book will be utilized, I am sure, for many years by professionals in the field.

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